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Claims

We claim:

1. Digital direct access arrangement circuitry for terminating a phone line connection, comprising:
5 powered side circuitry operable to communicate digitally with phone line side circuitry, said
 digital communication comprising a digital data stream in a pulse density modulation
 format transmitted across an isolation barrier; and
 phone line side circuitry operable to communicate digitally with powered side circuitry, said
 digital communication comprising a digital data stream in a pulse density modulation
10 format transmitted across said isolation barrier.
2. The digital direct access arrangement circuitry of claim 1, wherein communication across said
isolation barrier is bi-directional.
- 15 3. The digital direct access arrangement circuitry of claim 2, further comprising an isolation barrier
coupled between said powered side circuitry and said phone line side circuitry.
4. The digital direct access arrangement circuitry of claim 2, wherein said isolation barrier
comprises one or more capacitors.
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5. The digital direct access arrangement circuitry of claim 2, wherein said powered side circuitry
includes encode circuitry coupled to said digital data stream to generate an encoded digital signal for
transmission across said isolation barrier and wherein said phone line circuitry includes decode circuitry
to generate a decoded digital signal from said encoded digital signal.
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6. The digital direct access arrangement circuitry of claim 2, wherein said encoded digital signal
comprises control data added to said digital data stream.
7. The digital direct access arrangement circuitry of claim 2, wherein said encoded digital signal
30 comprises framing data added to said digital data stream for data synchronization within said phone line
side circuitry.

8. The digital direct access arrangement circuitry of claim 2, wherein said encoded digital signal comprises said digital data stream formatted such that said decode circuitry may recover a clock signal from said encoded digital signal.
- 5 9. The digital direct access arrangement circuitry of claim 2, wherein said phone line side circuitry includes encode circuitry coupled to said digital data to generate an encoded digital signal for transmission across said isolation barrier and said powered circuitry includes decode circuitry to generate a decoded digital signal from said encoded digital signal.
- 10 10. The digital direct access arrangement circuitry of claim 2, wherein said encoded digital signal comprises control data added to said digital data stream.
11. The digital direct access arrangement circuitry of claim 2, wherein said control data comprises phone line status information.
- 15 12. The digital direct access arrangement circuitry of claim 2, wherein said powered side circuitry has a communication interface that may be coupled to an external device.
13. The digital direct access arrangement circuitry of claim 2, wherein said phone line side circuitry
20 has analog output signals that may be coupled to phone lines through hook-switch circuitry and diode bridge circuitry.
14. Powered side circuitry for digital direct access arrangement circuitry for terminating a phone line connection, comprising:
25 a communication interface that may be coupled to an external device;
an isolation interface that may communicate digitally with phone line side circuitry through an isolation barrier; and
encode circuitry within said isolation interface to generate an encoded digital signal from a digital data stream for transmission across said isolation barrier.
- 30 15. The powered side circuitry of claim 14, wherein said encoded digital signal comprises control data added to said digital data stream.

16. The powered side circuitry of claim 14, wherein said encoded digital signal comprises framing data added to said digital data stream for data synchronization within said phone line side circuitry.

17. The powered side circuitry of claim 14, wherein said encoded digital signal comprises said digital data stream formatted such that said decode circuitry may recover a clock signal from said encoded digital signal.

18. The powered side circuitry of claim 14, wherein said digital data signal is a digital data stream in a pulse density modulation format.

19. The powered side circuitry of claim 14, wherein said isolation interface may communicate bi-directionally across said isolation barrier.

20. The powered side circuitry of claim 14, wherein signals communicated through said communication interface comprises digital data signals, control signals and phone line status signals.

21. The powered side circuitry of claim 20, wherein said communication interface comprises a digital serial port interface.

22. The powered side circuitry of claim 14, further comprising an oversampled delta-sigma modulator coupled to receive base-band digital data signals from said external device and to convert said base-band digital data signals to a digital data stream in a pulse density modulation format.

23. The powered side circuitry of claim 14, further comprising decode circuitry that may be coupled to an encoded digital signal received from said phone line side circuitry to generate a decoded digital signal.

24. The powered side circuitry of claim 23, wherein said decoded digital signal comprises a digital data stream in a pulse density modulation format, and further comprising a digital filter coupled to said digital data stream to generate base-band digital data signals.

25. Phone line side circuitry for digital direct access arrangement circuitry for terminating a phone line connection, comprising:

a communication interface that may be coupled to phone lines;
an isolation interface that may communicate digitally with powered side circuitry through an
isolation barrier; and
decode circuitry within said isolation interface to generate a decoded digital signal from an
5 encoded digital signal received from said powered side circuitry across said isolation
barrier.

26. The phone line side circuitry of claim 25, wherein said encoded digital signal comprises a digital
data stream formatted such that said decode circuitry may recover a clock signal from said encoded
10 digital signal.

27. The phone line side circuitry of claim 25, wherein said encoded digital signal comprises control
data added to a digital data stream.

15 28. The phone line side circuitry of claim 25, wherein said encoded digital signal comprises framing
data added to a digital data stream for data synchronization within said phone line side circuitry.

29. The phone line side circuitry of claim 25, wherein said isolation interface may communicate bi-
directionally across said isolation barrier.

20 30. The phone line side circuitry of claim 25, wherein signals communicated through said
communication interface comprises analog data signals.

31. The phone line side circuitry of claim 25, wherein said communication interface is configured to
25 be coupled to phone lines through external hook-switch circuitry and an external diode bridge.

32. The phone line side circuitry of claim 25, wherein said communication interface comprises
circuitry coupled to said phone lines to detect ringing on said phone-lines and to control an off-hook state
on said phone lines.

30 33. The phone line side circuitry of claim 32, wherein said communication interface comprises DC
termination circuitry coupled to said phone lines to provide an internal DC power supply to said phone
line side circuitry.

34. The phone line side circuitry of claim 25, further comprising an oversampled delta-sigma analog-to-digital converter configured to be coupled to analog signals received from said phone lines to convert said analog signals to a digital data stream in a pulse density modulation format.

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35. The phone line side circuitry of claim 25, further comprising encode circuitry within said isolation interface to generate an encoded digital signal from a digital data stream for transmission across said isolation barrier.

10 36. The phone line side circuitry of claim 35, wherein said encoded digital signal comprises control data added to said digital data stream.

37. The phone line side circuitry of claim 35, wherein said control data comprises phone line status information.

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38. The phone line side circuitry of claim 25, wherein said digital data signal is a digital data stream in a pulse density modulation format.

39. A method for communicating with phone lines, comprising:
20 converting a signal received from phone lines into a digital data stream in a pulse density modulation format;
communicating said digital data stream across an isolation barrier from phone line side circuitry to powered side circuitry;

25 40. The method of claim 39, wherein said isolation barrier comprises one or more capacitors.

41. The method of claim 40, further comprising:
communicating a digital bit stream across said isolation barrier from said powered side circuitry to said phone line side circuitry; and
30 recovery a clock signal within said phone line side circuitry from said digital bit stream.

42. The method of claim 40, further comprising:
encoding said digital data stream prior to said communicating step.

43. A method for communicating with phone lines, comprising:
converting a digital signal into a digital data stream in a pulse density modulation format; and
communicating said digital data stream across an isolation barrier from powered side circuitry to
5 phone line side circuitry.
44. The method of claim 43, wherein said isolation barrier comprises one or more capacitors.
45. The method of claim 44, further comprising:
10 recovery a clock signal within said phone line side circuitry from said digital bit stream.
46. The method of claim 45, further comprising:
encoding said digital data stream prior to said communicating step.
- 15 47. A method for communicating with phone lines, comprising:
generating an encoded digital signal from a digital data signal; and
communicating said encoded digital signal across an isolation barrier from phone line side
circuitry to powered side circuitry.
- 20 48. The method of claim 47, wherein said generating step comprises adding control data and phone
line status information to said digital data stream.
49. The method of claim 47, further comprising:
communicating a digital bit stream across said isolation barrier from said powered side circuitry
25 to said phone line side circuitry; and
recovery a clock signal within said phone line side circuitry from said digital bit stream.
50. The method of claim 49, wherein said isolation barrier comprises one or more capacitors.
- 30 51. A method for communicating with phone lines, comprising:
generating an encoded digital signal from a digital data signal; and
communicating said encoded digital signal across an isolation barrier from powered side
circuitry to phone line side circuitry.

52. The method of claim 51, wherein said generating step comprises adding control data and synchronization framing information to said digital data stream.

5 53. The method of claim 51, wherein said generating step comprises formatting said digital data stream so that a clock signal may be recovered from said encoded digital signal.

54. The method of claim 53, wherein said generating step comprises adding control data and synchronization framing information to said digital data stream. ✓

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55. The method of claim 54, wherein said isolation barrier comprises one or more capacitors